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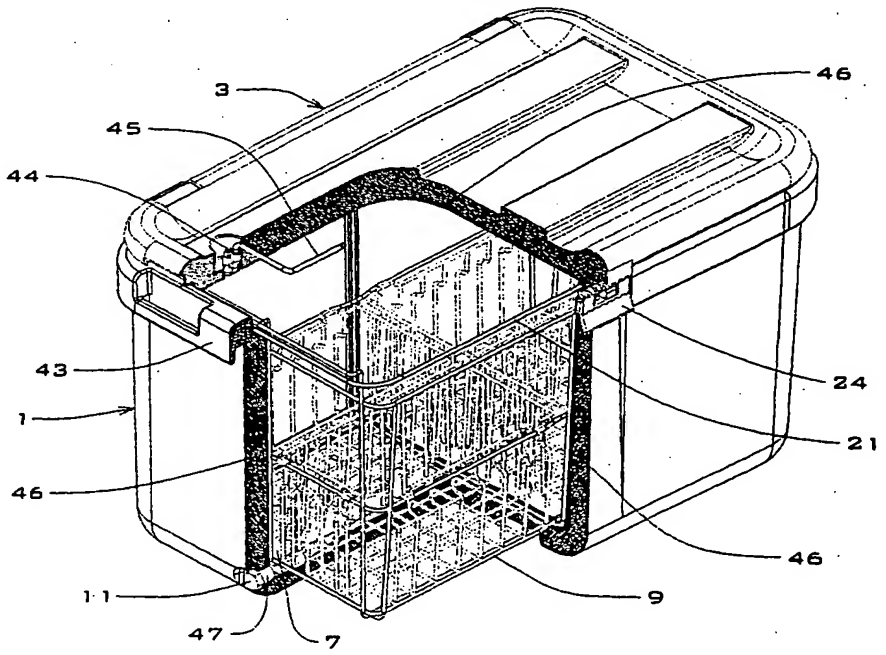
(54) Title: MEDICAL TRANSPORT CONTAINER




(57) Abstract: A medical transport container (1) for transporting donor organs, the container having an interior storage volume (7) which can be hermetically sealed, wherein the container includes a valve means (15, 17) for allowing air to be extracted from the storage volume such that a sub-atmospheric pressure can be maintained therein.



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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

# MEDICAL TRANSPORT CONTAINER

The present invention is generally directed at transport containers, and in particular to medical transport containers used in the transport of donor organs. Although the container according to the present invention will be described with respect to medical applications, it is to be appreciated that the container is also applicable for recreational, domestic and other applications.

Organs such as kidneys and livers deteriorate rapidly once the blood supply is cut to these organs. This deterioration process can be slowed by cooling the organ. Therefore, where an organ is removed from a donor, and it is not possible to immediately transplant that organ into a recipient patient because that patient is at a different location to the donor, then the organ needs to be transported while in a cooled state. In the case of kidneys, it is possible to conserve them for 24 to 48 hours by infusing a cold solution into the blood vessels and storing the kidney at about 4 degrees Celcius in a refrigerator or surrounded by ice in a vacuum flask. Such a kidney can also be transported within a thermally insulated container over long distances to the patient.

The container typically used to transport kidneys and other organs is made from thermally insulating material such as polystyrene to maintain the organ cool for as long as possible while being transported.

It has however been found that the organ can be conserved for a longer period if the organ is stored within a sub atmospheric pressure environment.

It is therefore an object of the present invention to provide an improved medical transport container for the transport of donor organs.

With this in mind, the present invention provides a medical transport container for transporting donor organs, the container having an interior storage volume which can be hermetically sealed, wherein the container includes a valve means for allowing air to be extracted from the storage volume such that a sub-atmospheric pressure can be maintained therein.

The valve means can be connected to a vacuum pump to extract air from the storage volume such that the pressure within the storage volume is below atmospheric. Therefore, an organ stored within the transport container can be subjected to a sub-atmospheric pressure therein.

The container may include a container body having a lid, with a hermetic seal being provided between the container body and the lid. At least the container body may be thermally insulated. The lid may also thermally insulated. To this end, at least the container body may be formed as an outer plastic shell having inner and outer walls. The shell may be filled with a thermally insulating material. The outer shell may for example be produced from high density polyethylene in a rotor mould production process and subsequently injected with a thermally insulating material such as polystyrene foam. The lid may also be made with the same manufacturing process using the same material. The use of other materials is however also envisaged.

The valve means may include a connection means for connecting to a vacuum pump and a valve arrangement may be located within a wall of the container. The connection means may include a suction line or spigot for connecting the valve arrangement to the vacuum pump, and the valve arrangement may be in the form of a check valve for allowing air to pass out of the storage volume while preventing the ingress of air therein. The valve arrangement may further include means to allow air to bleed back into the storage volume following evacuation thereof, to facilitate subsequent opening of the lid.

A seal means may be provided between the container body and the lid to allow for the hermetic sealing of the container. In an example embodiment, the container body may have an access opening surrounded by a peripheral internal shoulder. The lid is locatable over the access opening and may having an external shoulder adapted to cooperate with the internal shoulder of the access opening when located thereon. An "o-ring" type seal may be provided between the internal and external shoulders to provide the necessary hermetic seal. Seals of alternative configurations are also envisaged.

The lid may be supported on the container body by a hinge arrangement along one side thereof. A coupling arrangement may be provided on the opposing side of the lid to couple the lid to the container body when closed over the access opening. The coupling arrangement may include means for urging the lid against the container body to ensure that there is little to no leakage of air between the lid and the container body. The coupling arrangement may therefore include a catch including a body member hinged to either the lid or the container

body. The cooperating container body or lid may include a lug extending therefrom, and the body member of the catch may include an opening for accommodating the lug therein when the lid is closed over the access opening. The catch may further include an abutment member connected by a middle hinge to the body member. The abutment member may include at least one cam, which may extend into the opening of the body member as the abutment member is pivoted about the middle hinge. The cam may abut the lug when located within the opening of the body member. Pivotal movement of the abutment member will urge the cam against the lug such that a pulling force is applied to the body member, and therefore the lid against the container body. The coupling arrangement may be flush with the outer surface of the container once the abutment member is pivoted to its final position.

The medical transport container according to the present invention allows the transport of donor organs under sub-atmospheric pressures. This enables the organ to be stored in the container for a longer period than conventional thermally insulated containers.

It will be convenient to further describe the invention with respect to the accompanying drawings, which illustrate a preferred embodiment of a medical transport container according to the present invention. Other embodiments of the invention are possible, and consequently, the particularity of the accompanying drawings is not to be understood as superseding the generality of the preceding description of the invention.

In the drawings:

Figure 1 is a perspective view of a medical transport container according to the present invention;

Figure 2 is a cut-out perspective view of the container of Figure 1;

Figure 3 is a top view of the container of Figure 1;

Figure 3a is a cross-section view of the container taken along line A-A of Figure 3;

Figure 4 is another cutout view of the container of Figure 1 with the lid open;

Figure 5 to 5b are respectively detailed perspective views of the coupling arrangement of the container of Figure 1 showing in sequence the operation of the coupling arrangement; and

Figure 6 to 6b are cross-sectional views of the coupling arrangement as respectively shown in Figures 5 to 5b.

Referring initially to Figures 1 to 4, the medical transport container according to the present invention includes a container body 1, and a lid 3 hingedly supported on the container body 3 by a hinge 48 to cover an access opening 5 of that container body. The container body 1 has an internal storage volume 7 within which is accommodated a wire basket 9. Alternatively, the storage volume 7 can be separated by a wall panel 9 into two separate sections. The container body 1 is provided with a drain plug 11 having a threaded section 47 for engaging a cooperating bore in the container body 1. This drain plug 11 can be removed to allow the drainage of fluid from within the container.

Provided within the lid is a cavity 13 within which is located a valve arrangement 15. This valve arrangement 15 is provided with a suction line 45 to which a vacuum pump can be attached. The valve arrangement 15 is in the form of a flow control check valve which allows the extraction of air from within the internal volume 7 through an aperture 50 provided in the underside of the lid 3 while preventing the flow of air through the valve 15 from that internal volume. This check valve 15 is dual action and includes a needle valve 44 that can be opened to allow air back into the internal volume 7 thereby returning the pressure therein to atmospheric facilitating the opening of the container.

The container further includes an O-ring type seal 21 located between the lid 3 and container body 1 to thereby provide a hermetic seal for the container. A coupling arrangement 24 retains the lid 3 in a closed position over the access opening 5 of the container body 1.

Both the container body 1 and lid 3 are formed with an outer shell made of plastic such as high density polyethylene. This outer shell can be made in a rotor mould production process. The shell can then be injected with a polystyrene foam to provide a central thermally insulating core for both the container body 1 and the lid 3.

Figure 3a and 4 shows in more detail the cooperation of the container body 1 and lid 3. The container body 1 includes an inner shoulder 25 surrounding the access opening 5 thereof. The lid is provided with an outer shoulder 27 which cooperates with and rests within the confines of the inner shoulder 25 of the container body 1 when the lid is located over and closes the access opening 5. The O-ring type seal 21 is located within a channel 29 provided at the base of the inner shoulder 25 of the container body 1. This allows the seal 21 to provide a hermetic seal between the container body 1 and lid 3 when the container is closed.

Figures 5 to 6b show in more detail the coupling arrangement 24 which includes a catch 32 having a body member 33 hingedly mounted on the lid 3 via a hinge joint 52. The body member 33 has an opening 35 passing therethrough. A lug 31 extends from the container body 1. This lug 31 is accommodated within the opening 35 of the coupling arrangement 24 when the lid 3 is closed over the access opening 5 of the container body 1. The coupling arrangement 24 further includes an abutment member 34 hingedly connected to the body member 33 via hinge joint 51. The abutment member 34 includes a series of cams 37 which can extend into the area of the opening 35 of the body member 33 as it is rotated about its hinge joint 51. Figure 6 shows in more detail the position of the cams 37 as the catch 32 approaches its closed position. The cams 37 are displaced into the opening as to abut and press against the lug 31 of the container body 1 thereby providing a pulling force on the body member 33 of the catch 32 and thereby pulling the lid 3 against the container body 1. This also results in pressure being applied on the seal 21. Figure 1 shows that the catch 32 is flush with the outer surface of the container body 1 when fully closed.

The lid 3 is formed with a series of ribs 39. The bottom of the container body 1 is provided with a series of channels 41. This allows the containers to be securely stacked one on top of each other, with the ribs 39 of the lid 3 engaging the channels 41 of the next container. Also provided at one end of the container body 1 is a coupling member 43. At the opposing end of the container body is a coupling hook members 55 (see Figure 3) that can engage the coupling member. Therefore two adjacent containers abutting end to end can be held together by

coupling the coupling hook members 55 to the coupling member 43 of the adjacent container.

The medical transport container according to the present invention provides a thermally insulated enclosure for a donor organ being transported. Furthermore, the container can be hermetically sealed and air extracted from the inner volume 7 such that the donor organ is stored in sub atmospheric pressure conditions. This allows the organ to be conserved for a longer period within the container.

Modifications and variations as would be deemed obvious to the person skilled in the art are included within the ambit of the present invention as detailed in the appended claims.

Claims:

1. A medical transport container for transporting donor organs, the container having an interior storage volume which can be hermetically sealed, wherein the container includes a valve means for allowing air to be extracted from the storage volume such that a sub-atmospheric pressure can be maintained therein.

2. A medical transport container according to claim 1, wherein the valve means includes a connection means for connecting to a vacuum pump, and a valve arrangement provided within a wall of the container for allowing air to pass into the storage volume while preventing the exit of air therefrom.

3. A medical transport container according to claim 2, wherein the connection means includes a suction line for connecting to the vacuum pump, and the valve arrangement is in the form of a dual action flow control check valve.

4. A medical transport container according to any one of the preceding claims, wherein the container includes a container body and a lid for covering an access opening of the container body, with a hermetic seal being provided between the container body and the lid.

5. A medical transport container according to claim 4, wherein at least the container body is thermally insulated.

6. A medical transport container according to claim 5, wherein the lid is also thermally insulated.

7. A medical transport container according to claim 5 or 6, wherein at least the container body is formed from a plastic outer shell filled with a thermally insulating material.

8. A medical transport container according to any one of claims 4 to 6, wherein the valve means is located in the lid.

9. A medical transport container according to any one of claims 4 to 6, wherein the lid is supported on the container body by a hinge arrangement along one side thereof, with a coupling arrangement being provided on the opposing side thereof, wherein the coupling arrangement urges the lid against the container body when closed over the container body to thereby apply a compression force on the seal therebetween.

10. A medical transport container according to claim 9, wherein the coupling arrangement includes a lug located on one of the container body or lid, and a catch located on the cooperating lid or container body, the catch including a body member hingedly connected thereto, the body member having an opening for accommodating the lug when the lid is closed over the container body, the catch further including an abutment member hingedly connected to the body member and having at least one cam which can extend into the body member opening as the abutment member is pivoted about its' hinge connection.

11. A medical transport container according to claim 9 or 10, wherein the coupling arrangement lies flush against the outer surface of the container body when in its closed position.

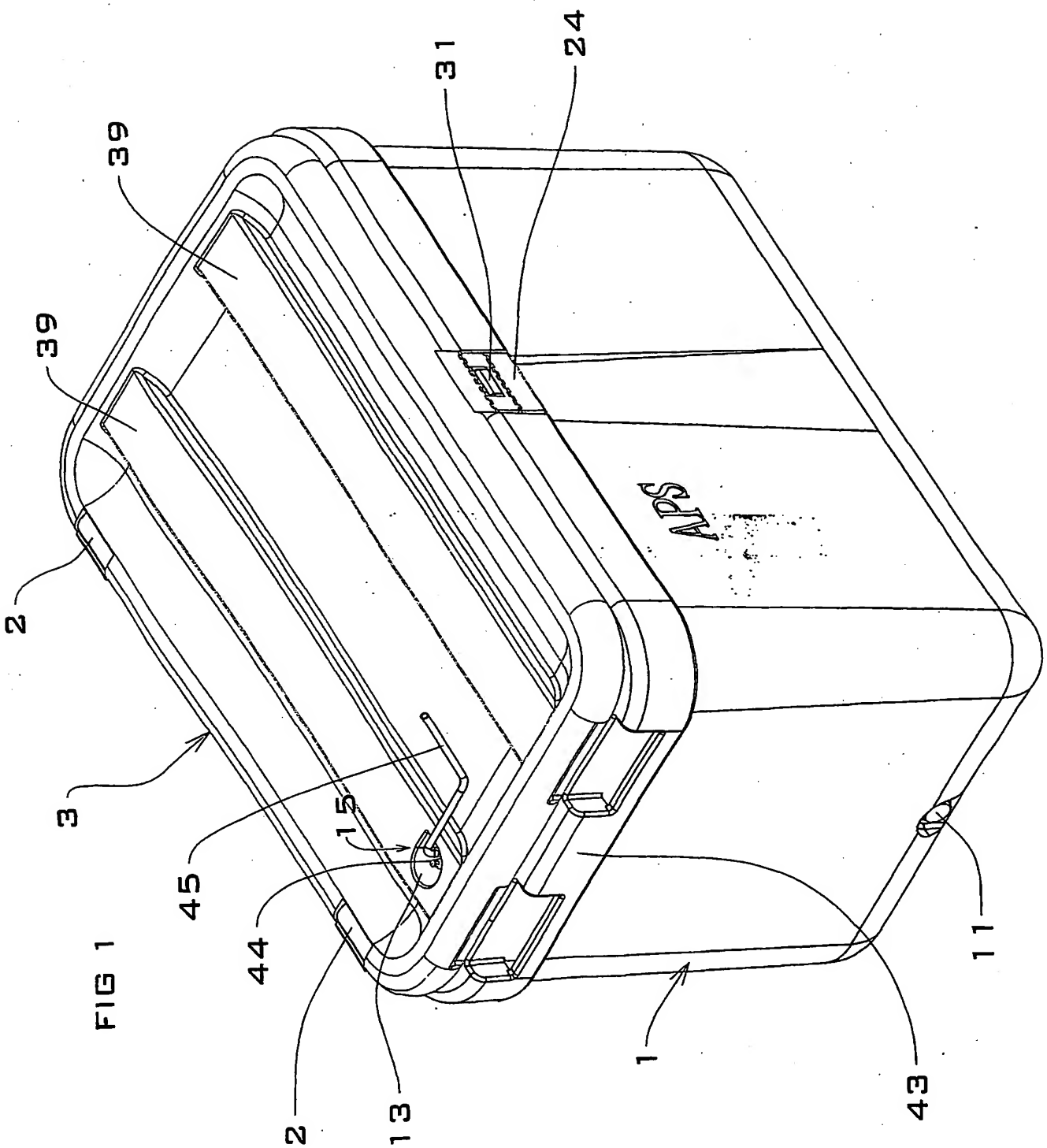


FIG 1

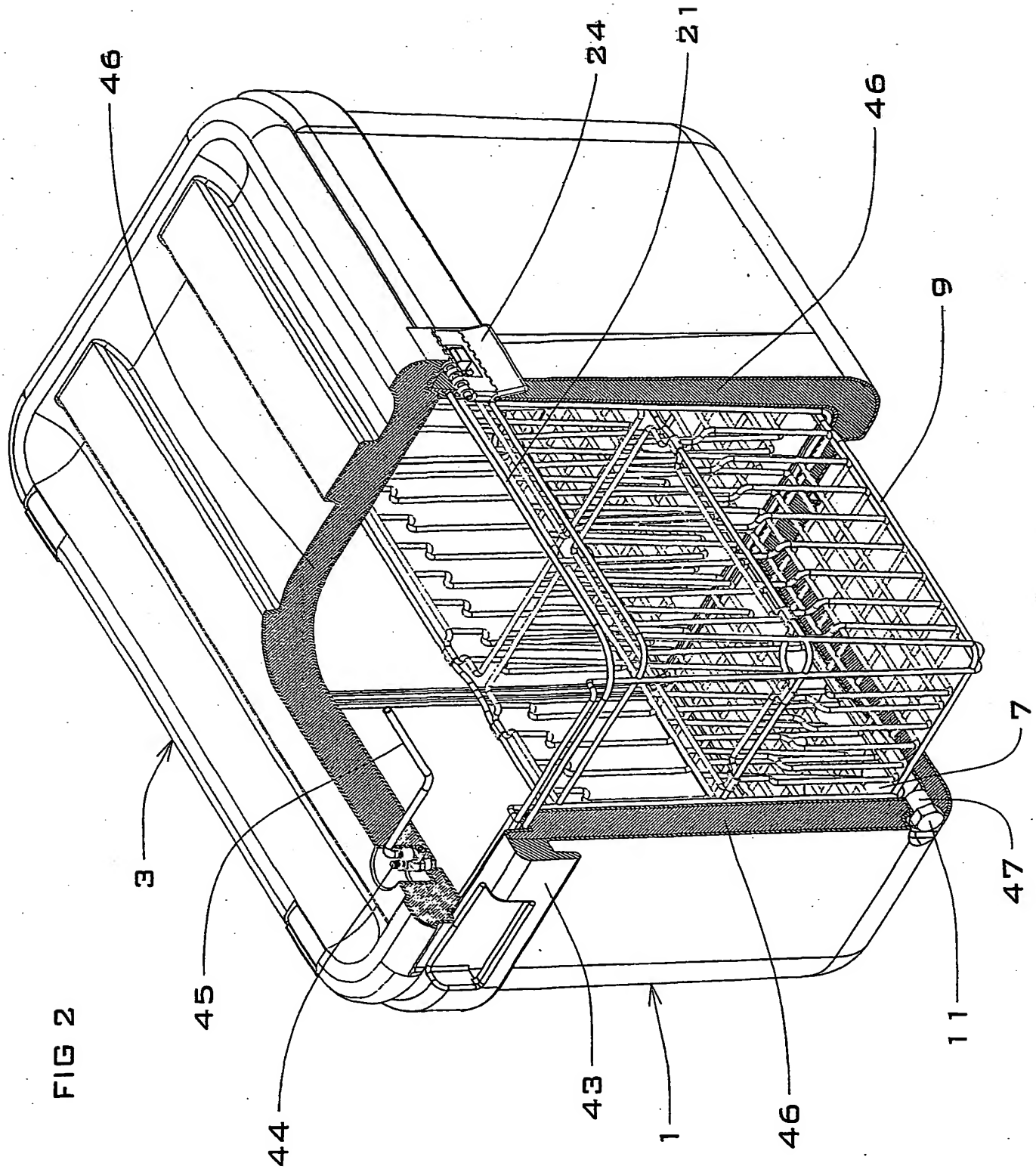


FIG 2

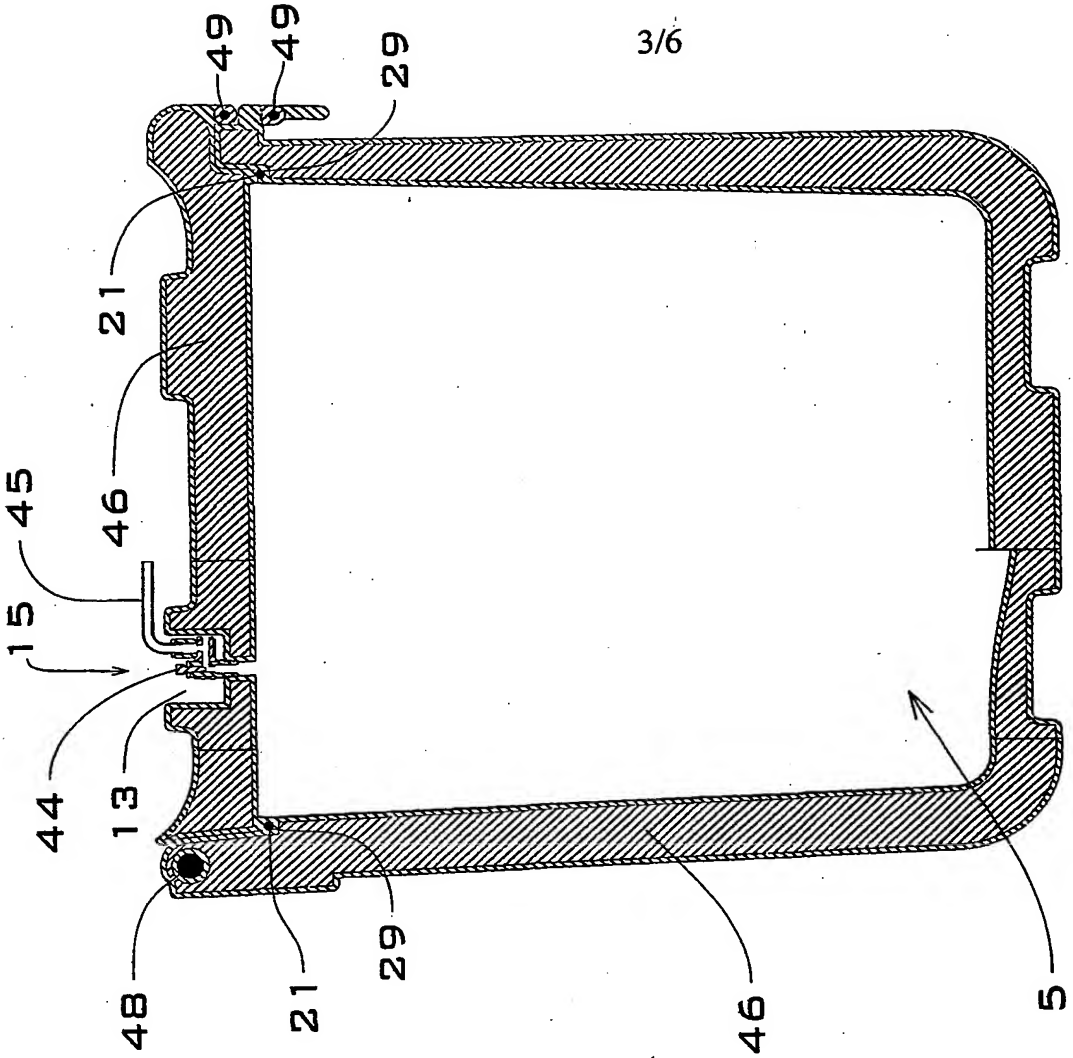


FIG 3A

SECTION A - A

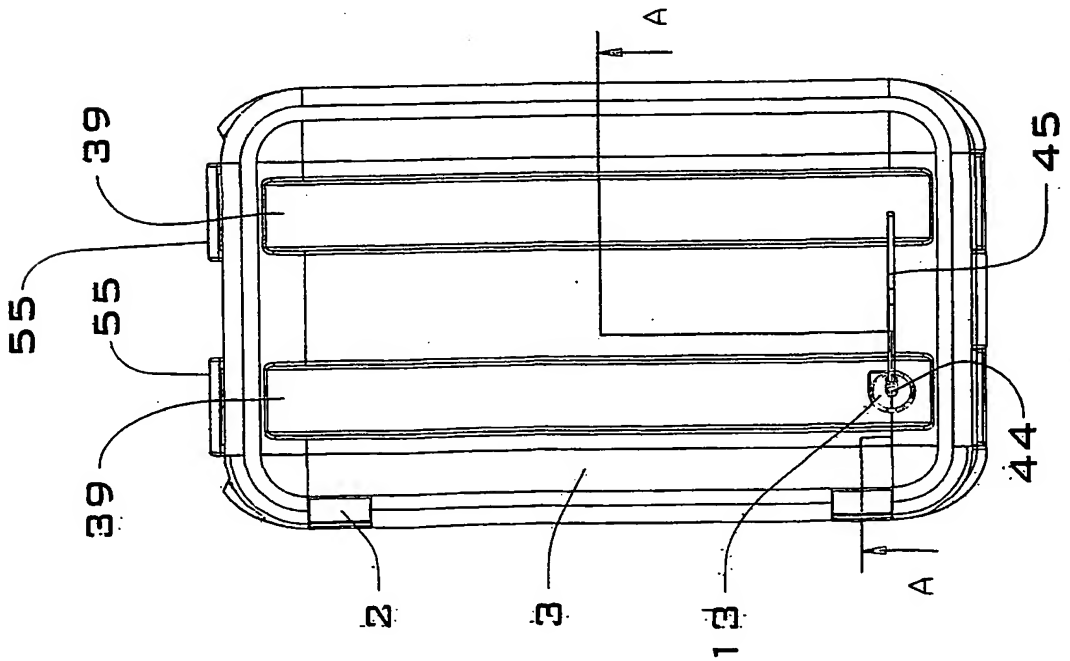


FIG 3

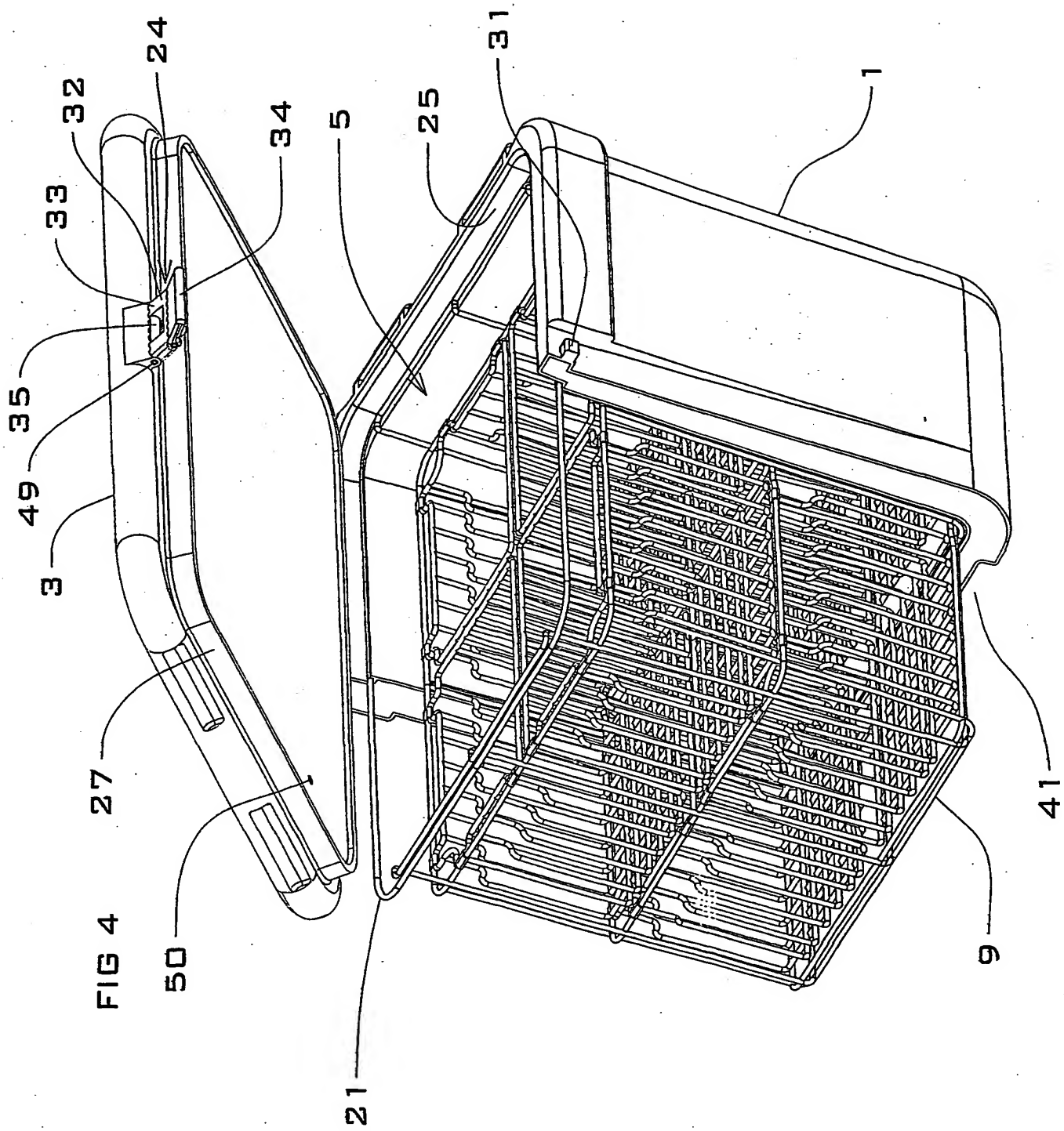


FIG 4

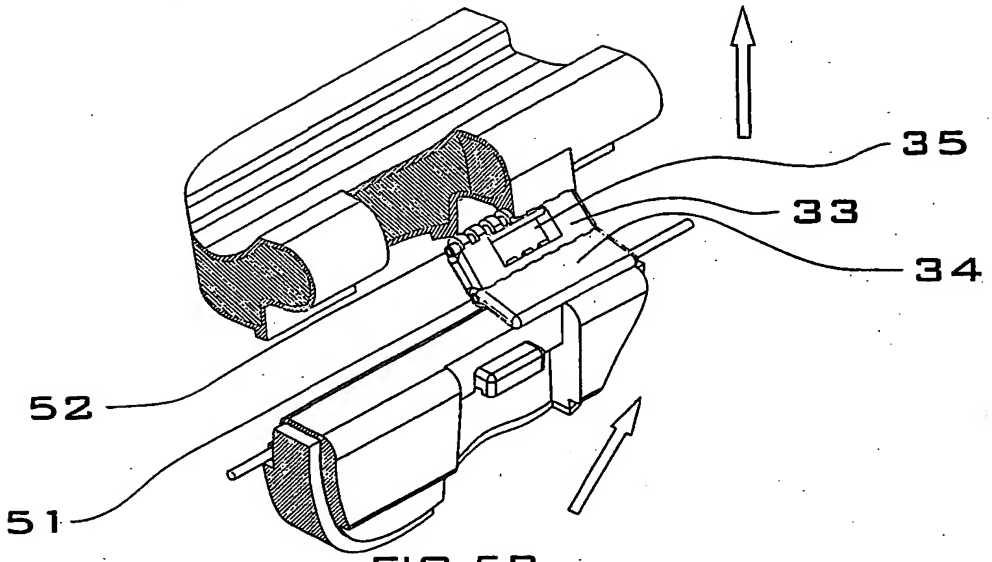


FIG 5B

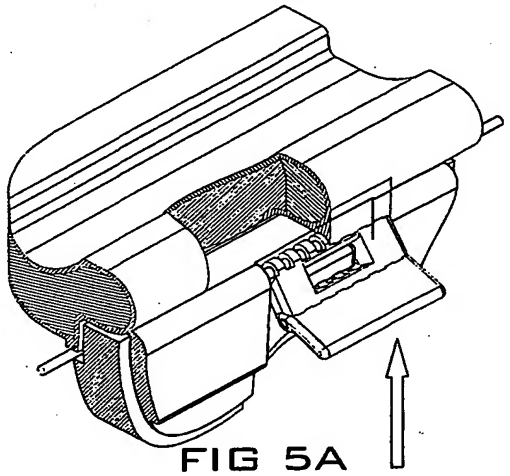

FIG 5A

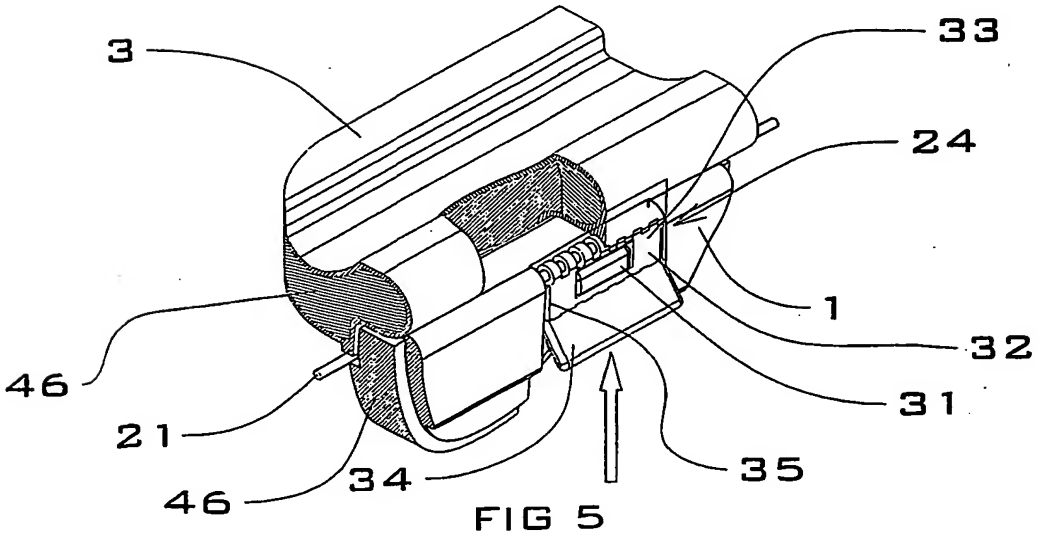


FIG 5

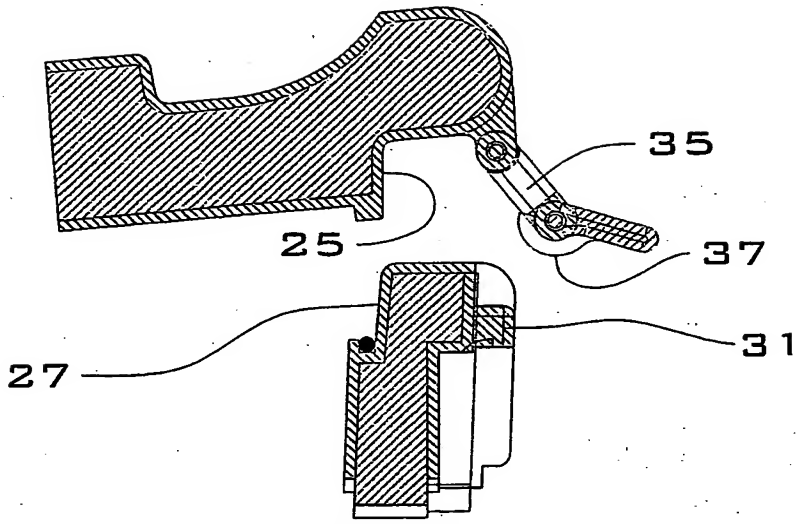


FIG 6B

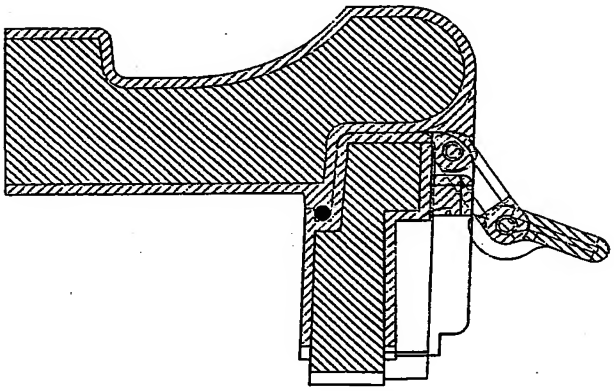

FIG 6A

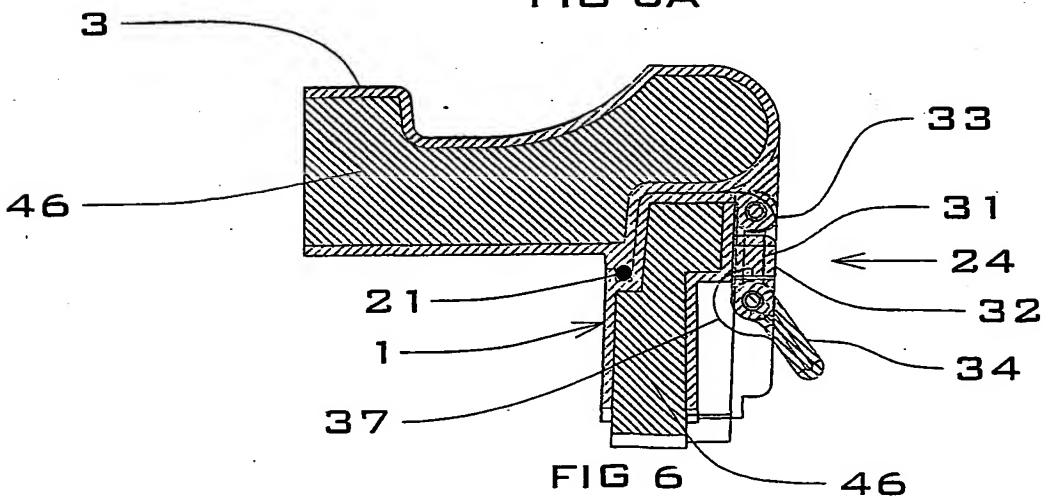


FIG 6

INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU01/01077

**A. CLASSIFICATION OF SUBJECT MATTER**

Int. Cl. [7]: B65B 31/04, B65D 81/20, 85/50, A61J 1/00, F25D 3/08

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

SEE ELECTRONIC DATA BASE BELOW

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

DWPI & IPC - A01N 1/02, A61B 19/-, A61J 1/-, B65B 31/04, B65D 81/20, 85/50, F25D 3/08 & Keywords (organ, hermetic, vacuum, transport, valve, pump) and similar terms & USPTO & similar keywords

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | US 5960708 A (DETEMPLE et al.) 5 October 1999<br>See particularly abstract and figs 1 & 2 | 1-11 |
| X | EP 287555 B (MAYER et al) 19 October 1988<br>See whole document, particularly figs and English abstract | 1-5,8 |
| X | US 5339959 A (CORNWELL) 23 August 1994<br>See whole document, figs 2 & 6 | 1 |

[X] Further documents are listed in the continuation of Box C [X] See patent family annex

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| Date of the actual completion of the international search | Date of mailing of the international search report |
|---|---|
| 21 September 2001 | 27 SEPTEMBER 2001 |
| Name and mailing address of the ISA/AU<br>AUSTRALIAN PATENT OFFICE<br>PO BOX 200, WODEN ACT 2606, AUSTRALIA<br>E-mail address: pct@ipaustralia.gov.au<br>Facsimile No. (02) 6285 3929 | Authorized officer<br>STEPHEN CLARK<br>Telephone No : (02) 6283 2781 |

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/AU01/01077

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|---|---|---|
| X | Derwent Abstract Accession No. 1999-419668/36, Class Q34, CN 1215689 A (WANG) 5 May 1999 | 1 |

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/AU01/01077

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. The Australian Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

| Patent Document Cited in Search Report | | Patent Family Member | | | |
|---|---|---|---|---|---|
| US | 5960708 | EP | 1087672 | WO | 99/65340 |
| EP | 287555 | AT | 957/87 | | |
| US | 5339959 | JP | 7265365 | US | 5203458 |
| CN | 1215689 | NONE | | | |

END OF ANNEX